



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/777,026      | 02/11/2004  | Mark N. Kawaguchi    | 8033/ETCH           | 2197             |

55649 7590 10/12/2007  
MOSER IP LAW GROUP / APPLIED MATERIALS, INC.  
1030 BROAD STREET  
2ND FLOOR  
SHREWSBURY, NJ 07702

|          |
|----------|
| EXAMINER |
|----------|

TRAN, BINH X

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

1792

|                   |               |
|-------------------|---------------|
| NOTIFICATION DATE | DELIVERY MODE |
|-------------------|---------------|

10/12/2007

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ATABOADA@MOSERIPLAW.COM  
DOCKETING@MOSERIPLAW.COM

|                              |                                      |   |  |
|------------------------------|--------------------------------------|---|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/777,026 | <b>Applicant(s)</b><br>KAWAGUCHI ET AL. |  |
|                              | <b>Examiner</b><br>Binh X. Tran      | <b>Art Unit</b><br>1765                 |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 27 September 2007.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11-23, 25-31 and 35-42 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8, 11, 12, 17-19, 21-23, 25-30 and 35-42 is/are rejected.
- 7) ☒ Claim(s) 9, 13-16, 20, 31 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Arguments***

1. Applicant's arguments, see pages 9-10, filed 9-27-2007, with respect to the rejection(s) of claim(s) 1-2, 4-8, 17-19, 21-22, 26-30 under 35 USC 103 as being unpatentable over Liu in view of Byun have been fully considered and are persuasive. Therefore, the previous final rejection (mailed on 07-27-2007) has been withdrawn. However, upon further consideration, a new ground(s) of final rejection is made as discussed below.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Art Unit: 1765

4. Claims 1-2, 4-8, 17-19, 21-22, 26-30, 38, 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (US 6,774,045 B1) in view of Narwankar et al. (US 6,204,203).

Respect to claims 1-2, 21-22 Liu discloses a method for removing halogen-containing residue from a substrate, (abstract), the method comprising the steps of:

providing a substrate having a polysilicon layer on the substrate;

etching the polysilicon layer and forming a halogen-containing residues, comprising at least chlorine or bromine on the substrate, (Table 1-6, col. 2-6);

heating the etched substrate to the temperature at a temperature of 20-300 °C (col. 10 line5-18, 33-44, read on applicant's range of "at least 50 °C" and/or "50 °C to about 450 °C" for claims 2 and 22);

exposing the heated substrate to a plasma that removes the halogen-containing residues (col. 10 lines 10, 35, Fig 2, Fig 3, Table 5-6).

Liu fails to disclose heating the etch substrate in a non-plasma mixture comprising oxygen and nitrogen. However, Liu clearly teaches to heat the substrate. Narwankar teaches to heat the substrate at a temperature 400-650 °C in a non-plasma (i.e. using rapid thermal process) gas mixture comprising oxygen and nitrogen under rapid thermal annealing order to remove carbon from the surface (col. 7-8). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Liu in view of Narwankar by heating using non-plasma mixture comprising oxygen and nitrogen because it will remove carbon from the surface (col. 7 lines 53-62).

Respect to claims 4 and 26, Liu discloses the halogen-containing residue comprises bromine (col. 2 lines 1-10, Table 6). Respect to claim 5, and 27, Liu disclose the plasma comprises oxygen-containing gas (Table 5-6). Respect to claims 6 and 28, Liu disclose the oxygen-containing gas comprises oxygen, H<sub>2</sub>O and an additive gas comprise nitrogen (Table 5-6). Respect to claims 7 and 29, Liu discloses the halogen-containing residue comprises chlorine (Fig 4, Table 5-6). Respect to claims 8 and 30, Liu discloses the plasma comprises hydrogen-containing gas (i.e. H<sub>2</sub>O, See Table 5-6). Respect to claims 17-18, Liu disclose the plasma comprises oxygen-containing gas at a pressure of 2 torr, at a duration about 30 seconds (Table 5, col. 5 lines 23-30). Respect to claims 19, Liu discloses maintaining the hydrogen-containing gas (H<sub>2</sub>O) at a pressure of 2 torr (Table 5). Respect to claims 38 and 42, Narwankar disclose the substrate is heated at a pressure of 100 Torr (col. 7 lines 34-35).

5. Claims 3, 11-12, 23, 35-37, 39-41 rejected under 35 U.S.C. 103(a) as being unpatentable over Liu and Narwankar and as applied to claims 1-2, 4-8, 17-19, 21-22, 26-30, 38, 42 above, and further in view of Chen et al. (US 5,545,289).

Claims 3 and 23 differ from Liu and Narwankar by further discloses forming the plasma by energizing a gas mixture in a remote plasma reactor. However, Liu clearly teaches to form a plasma by energizing a gas mixture using microwave source. Chen teaches to form a plasma by energizing a gas mixture in a remote plasma reactor using a microwave source (Fig 2). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Liu and Narwankar in view of Chen by using a remote plasma reactor because equivalent and substitution of one for the other would

produce an expected result. Further, remote plasma reactor is well known in semiconductor art.

Claim 11 differs from Liu by the further specifying the exposing step comprises maintaining the temperature of the substrate at about 250 °C. However, Liu clearly teaches the temperature is a result effective variable varying from 20-300 °C, including 160 °C, 220 °C and 280 °C (Fig 4). Chen teaches the temperature is a result effective varying from 250-300 °C (Table VII, read on applicant's temperature value). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal temperature as an expected result.

Claims 12, 36-37, 40-41 differ from Liu and Narwankar by the specific flow rate of oxygen and nitrogen gas or the flow rate ratio of O<sub>2</sub>: N<sub>2</sub>. However, Chen clearly teaches the flow rate of oxygen and nitrogen and flow rate ratio of O<sub>2</sub>:N<sub>2</sub> are a result effective variables (col. 7-88, col. 18). The result effective variables are commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal flow rate for oxygen and nitrogen as an expected result.

Respect to claims 35, 39, Liu and Narwankar fail to disclose the substrate is heated in a gas mixture of oxygen and nitrogen for a duration of about 10-20 seconds.

However, Narwankar clearly teaches to heat a substrate in a gas mixture comprises oxygen and nitrogen (col. 7-8). Chen teaches the duration of heating is a result effective variable. Chen further teaches to heat a substrate in a mixture of nitrogen and oxygen for a duration of 15-30 seconds including 20 seconds (Table VII). The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiment to obtain optimal duration as an expected result.

6. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liu and Narwankar and as applied to claims 1-2, 4-8, 17-19, 21-22, 26-30, 38, 42 above, and further in view of Wu (US 6,133,102).

Respect to claim 25, Liu fails to disclose the etching the substrate with a gas mixture comprising a halogen gas and a reducing gas. However, Liu clearly teaches to etch polysilicon using halogen gas (i.e.  $\text{CF}_4$ ,  $\text{HBr}$ ,  $\text{Cl}_2$ ; See Table 2). Wu teaches to polysilicon layer (120) by using halogen- containing gas ( $\text{CF}_4$ ) in addition with hydrogen gas (read on reducing gas) or  $\text{HBr}/\text{O}_2$  (col. 3 lines 41-51). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Liu and Narwankar in view of Wu by using halogen gas and reducing gas (i.e.  $\text{H}_2$ ) because equivalent and substitution of one for the other would produce an expected result

***Allowable Subject Matter***

7. Claims 9, 13-16, 20, 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
8. Claims 43-50 are allowed.
9. The following is a statement of reasons for the indication of allowable subject matter: The reason for allowance was discussed in previous office action.

***Conclusion***

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-

Art Unit: 1765

1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

*Binh Tran*

Binh X. Tran